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CROW DAMAGE TO FALL GRAIN CROPS IN OKLAHOMA IN 1937

With a Comparison of Field and Questionnaire Methods of Appraisal

By Ralph H. Imler, Junior Biologist, and E. R. Kalmbach, Senior Biologist
Section of Food Habits, Division of Wildlife Research

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EARLIER STUDIES

In 1920 and in several subsequent years the Biological Survey investigated damage inflicted by crows in Oklahoma with the view of finding practical means for reducing losses to crops. That there has been a real need for relief from crow depredations no one familiar with the field aspects of the problem has denied, and the Biological Survey has at all times recognized the necessity for locally protecting crops against crows. It has also stressed the importance of altering farm practices to obviate damage to late grain crops as far as possible, and it has experimented with poisons and traps for direct action against the birds.

At no time has the Survey engaged in extensive operations for the control of crows, its activities having been purely experimental, for the purpose of finding and recommending means of relief that would be economical, effective, and practicable. In recent years, however, as a result of continued depredations by crows upon late-maturing grain crops, increasing appeals have been made for active participation by the Federal Government in control operations. No doubt some impetus has been lent this movement by the rather spectacular "bombing," or dynamiting, of crow roosts, an activity engaged in with considerable success by the State Game and Fish Commission. Although ample evidence of the seriousness of crow depredations locally throughout the grain-raising sections of the State was disclosed by the earlier studies, comprehensive and reliable information on the extent of losses incurred over areas of considerable size was not available prior to 1938.

No one could estimate even crudely the aggregate financial loss caused by wintering flocks of crows. That glaring deficiency made it necessary to defer a series of discussions on the subject of possible Federal aid in crow control between officials of the Bureau of Biological Survey, the Oklahoma Agricultural and Mechanical College, and the State Extension Service, begun during the summer and early fall of 1937.

It was agreed, however, that the Extension Service, through a representative stationed at the Oklahoma A. and M. College would send a questionnaire to farmers throughout the State, [1] while the Biological Survey, through the assignment of the senior author of this report as an investigator would make an actual farm-to-farm appraisal of damage in representative areas during the late fall and winter of 1937-38. The data from these sources were expected to aid in determining whether the problem of crow control in Oklahoma was of sufficient magnitude to warrant Federal participation.

The field inspection part of this cooperative project covered 2 1/2 months (November 6, 1937, to January 20, 1938). A total of 38 days was spent in Grady County and three in immediately surrounding areas, 15 in Roger Mills and Beckham Counties, 11 in northwestern Oklahoma, and 9 in the southern part of the State and contiguous parts of Texas.

DISTRIBUTION AND ABUNDANCE OF CROWS IN OKLAHOMA

Reliable observers assert that during the past two or more decades there has been a gradual drift of Oklahoma's winter crow population westward, and possibly southwestward. At present (1938) there are few large roosts of crows within 50 miles of the northern boundary, the greatest winter concentration being in an area somewhat to the southwest of the center of the State that includes all of Grady County, approximately the eastern half of Caddo County, nearly all of Stephens County (the southwestern corner excepted), the western third of Garvin County, and the western two-thirds of McClain County. The limits of this area of abundance are clearly defined on the west and north, but are less definite on the northeast, east, and south. To the southeast of this area wintering crows are common over a wide range, extending across the Red River into Texas.

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[1] Ford Mercer, assistant State 4-H Club agent, directed the questionnaire, which was issued during November 1937, and it was through his energy and sincere interest that the numerous county agents were enlisted and through them individual farmers interrogated. Subsequently Mr. Mercer supervised the tabulation of the data in the 1,171 returns.

In western Oklahoma there is another aggregation of wintering crows centering in Roger Mills and Beckham Counties, bordering the Texas Panhandle. Much grain sorghum is grown in this section, and, although the density of the crow population there is probably greater than that in Grady County, both the area and the aggregate number of birds involved are smaller. North and northwest of this area, wintering crows were not numerous enough in 1937 to do serious damage.

In the extreme southwestern part of the State wintering crows had not been abundant until 1934, when the general drought caused a pronounced drift in that direction. Since then the winter population there has been variable, but in the season 1937-38 it was not sufficient to cause notable damage. A decrease in crow depredations in 1937 as compared with 1936 was particularly marked in Harmon, Jackson, and Greer Counties.

Throughout the eastern third of the State, which includes extensive hilly and wooded sections, there are many wintering crows, but their numbers do not compare with those farther west. In the southeastern and southern counties, however, there are sufficient concentrations to cause appreciable losses to pecans and peanuts, crops not within the scope of this investigation.

Although the field appraisal here reported upon was not extensive enough to permit an accurate estimate of the number of crows in Oklahoma, it is the opinion of Imler that in the winter of 1937-38, Grady County and those counties bordering it supported about one-third of them. In this area counts and estimates were made at numerous roosts ranging in size from those that included a few thousand crows to enormous ones, as that at Agawam, which, on December 16, 1937, was estimated to contain more than 200,000. That there were 1,000,000 to 1,250,000 in the Grady County area seems plausible and on that basis it may be estimated that 3,000,000 to 3,750,000 crows were in Oklahoma in the winter of 1937-38.

A total of 838,000 crows from the eight major roosts in the Grady County section were observed feeding over an area of about 2,592 square miles, thus giving an average of 325 birds to the square mile in this section of extreme concentration. At the roosts themselves, usually situated in low growths of oaks, numerous counts of the birds were made. Trees with crowns 8 to 10 feet in diameter frequently harbored 45 to 110 birds. Densities of one bird to 2 square feet of ground surface covered by the trees were not uncommonly observed, and near the center of a roost not far from Dempsey, Okla., where bombing operations were carried out, dead crows, which included probably all the birds occupying this spot, averaged 1.46 per square foot of ground surface.

FIELD APPRAISAL OF CROW DAMAGE, 1937-38

Methods

Before routine estimation of damage was begun, the appraiser (Imler) made an inspection of numerous fields of grain sorghums to determine what proportion of the crop, when shocked, was exposed to crow attack. He found that 50 to 60 percent of the heads were exposed at least in part, that about one-fourth of the exposed heads, or 12 to 15 percent of all the heads in the shocks, were completely accessible to crows, and that in the remaining partially exposed heads only about one-third of the grain could be readily obtained by the birds. Hence, 25 to 30 percent of all the shocked grain sorghum was available to them.

In the survey of damage, representative areas in a field were selected and several shocks in each chosen for appraisal of losses. If damage was restricted to a definite part of the field, its proportion of the whole was computed by measurement and final deductions made accordingly.

Estimate was first made of the proportion that the damaged heads constituted of all exposed heads in the sample shocks. The extent of injury on 10 damaged heads, selected at random on a shock, was then computed. With this information and the fore-mentioned data in hand, an estimate of the total damage could be made. For instance, if the exposed heads comprised 60 percent of the total crop and the damaged heads 40 percent of those exposed, the damaged heads would represent 24 percent of the crop. If detailed study of 10 sample heads, picked at random, disclosed a loss of 30 percent of the grain from these heads, further computation (30 percent of 24) would show a loss of 7.2 percent of the total crop. To avoid cumbersome decimals, the nearest whole number (7 in the case cited) would be used as an estimate of the loss on the sample shock. The procedure would be repeated on several representative shocks and the average of all shocks would be computed and then recorded as the percentage of loss for the field or part of the field appraised. Knowing the acreage of the field, the total loss could then be computed.

In standing grain, representative areas enclosing 100 heads were marked off and the damaged heads counted. The percentage of damage on these was then estimated and the loss on the sample area computed. For example, if 17 heads of the 100 showed damage averaging 20 percent of the grain on those heads, the loss on the plot would be computed thus: $\frac{17X20}{100}$ = 3.4 percent. By appraising several plots in this manner an average for a field was obtained. When only part of a field was damaged, the percentage loss on the damaged part was estimated and this figure reduced in proportion to the fraction of the field affected. Again, as in the case of shocked grain, the total loss in a field was computed from the known acreage.

In Oklahoma most of the Indian corn grown in the winter crow-concentration areas is harvested before the birds arrive in large numbers. Occasionally, however, late-planted crops may still be in the field in November and December. When this occurred, the crow damage to standing corn was appraised in a manner similar to that used for the grain sorghums. If the damaged corn had been removed from the field, the loss could be appraised only after inspecting both the harvested crop (in ricks or bins) and the badly damaged ears left on the standing stalks.

Losses of Grain in Grady County

The Grady County crow-concentration area, from which had come many complaints of damage, was selected as the site of the principal appraisal studies. The county was divided into 18 areas varying in size from one to two townships, and enough farms were worked in each to give a fair index to existing conditions.

From appraisals made on representative farms the loss on each area was computed, and by adding the area losses an estimate of the acres of grain sorghum and Indian corn destroyed was obtained (table 1, column 2). The relation of this acreage to the total acreage of each grain raised in the county gave the percentage loss (table 1, column 3). The farmer's estimate of loss made at the time the field appraisal was conducted is shown in the same tabulation (column 4).

TABLE 1.--Estimates of grain destroyed by crows in Grady County, Okla., in 1937

Crop	Appraiser's estimate of acres destroyed	Appraiser's estimate of crop destroyed	Farmers' estimate of crop destroyed
	Number	Percent	Percent
Grain sorghum...	1,534	3.8	6.0
Indian corn.....	691	1.7	2.9

To obtain the data on which table 1 is based, 210 farms, covering a total of 39,797 acres and comprising 5.6 percent of the area of Grady County, were inspected. In the course of the inspections the investigator often was accompanied by the crop owner, and the latter's appraisal of loss usually was obtained at that time. It was given, wholly independently however, without knowledge of the appraiser's opinion.

For converting the 3.8 percent loss of grain sorghums in the county into financial terms, the following facts were considered: (1) Grain sorghums grown in Oklahoma from 1924 to 1932 averaged 11.3 bushels per acre; (2) on this basis the estimated acreage loss in Grady County (1,534) in 1937 was equivalent to 17,331 bushels; and (3) the average farm price received for grain sorghums in Oklahoma from September 1937 to February 1938 was $1.02 per 100 pounds, or 53 cents per bushel. From these data, it appears that the financial loss of grain sorghums in Grady County was $9,185.43, which if prorated for the 40,000 acres of grain sorghums raised would amount to about 23 cents per acre. The extent of crow damage to all other crops in that county, which is the area generally conceded to present the most acute crow problem in the State, would probably not exceed that inflicted on the grain sorghums.

The 1.7 percent loss of Indian corn recorded in the county was based on the appraisal of 2,232 acres. Crows apparently preferred corn to grain sorghum when both were available, but in Oklahoma the sorghums are left in the field much later and consequently are more severely damaged. In the southwestern and central parts of the State the main corn crop is ready to gather in August or September. "June," or late-planted, corn suffers most from crow attacks, as it is usually put in after cotton or some other crop has failed or is in fields where spring winds prevent early planting on light, sandy soils. Damage of 13 percent was recorded on 158 acres of this late corn crop--representing a loss of grain greater than that observed in all the 2,074 acres of earlier-planted corn.

Losses in Other Sections

The only large winter concentration of crows observed in 1937 in western Oklahoma outside of Grady County was that found in Beckham and Roger Mills Counties. Although this concentration extended into adjacent Texas, no studies were made in that State. In the central part of this western Oklahoma crow territory the damage in 1937 was about as heavy as that of 1935 and 1936, but surrounding areas suffered very little in 1937 although they were severely affected in the preceding two years. Farmers in this area of concentration reported that crows had not been numerous prior to 1934. After 2 weeks spent appraising the extent of crow damage, a loss of 2.6 percent of the grain sorghum crop (as against a 3.8 percent loss in Grady County) was estimated; the average damage to corn, on the other hand, was appraised at 6.8 percent (compared with 1.7 percent in Grady County). This greater percentage loss of corn in the western area was due to later husking and could have been largely avoided. The 39 farms appraised in the area contained 143 acres of corn and 1,483 acres of grain sorghums.

In three Panhandle counties of Oklahoma there was no damage by wintering crows except a very little in the southeastern corner of Beaver County. Losses in the two northern tiers of counties also were not serious in 1937; in some of these counties the farmers are actually opposed to crow control because they feel that the bird helps them by feeding on white grubs (Phyllophaga sp.) in wheat fields. This was especially true in an area extending southward from Grant and Kay Counties to Canadian and other western Oklahoma counties.

Although some information on the destructiveness of the crow was obtained from points to the east and south of the areas of intensive damage, it consisted mainly of general impressions of damage, obtained from county agricultural agents and farmers. In that part of the State east of the eastern border of Payne and Lincoln Counties extended, the numbers of crows and their damage are of distinctly less significance. Although the birds are common throughout this hilly and wooded country, their roosts are smaller and the fields of grain are less extensive; consequently there are fewer complaints of damage.

The results of field studies and the returns from questionnaires both show that in Oklahoma the southwestern part harbors the densest winter crow population. Correspondingly it is generally recognized that crow damage is greatest in that section. Even within this southwestern section Imler found that severe damage centered in areas of pronounced crow concentration. One of these, in and immediately around Grady County, was the scene of his appraisal studies, which indicated losses of 3.8 percent in grain sorghums and 1.7 percent in Indian corn. In the absence of direct appraisal in all the other less thickly crow-infested areas, one cannot state positively what the State-wide percentage of loss to these two grains would be, but with Grady County producing approximately 40,000 of the State's 1,316,000 acres of grain sorghum and 38,000 of the State's 1,811,000 acres of Indian corn, it is apparent that the acute conditions presented in that county (and in parts of Roger Mills and Beckham Counties) prevail in only a relatively small proportion of Oklahoma's total acreage of these crops. That the percentage of loss must be materially less elsewhere is evidenced by the fact that probably one-third of the winter crow population of the entire State is concentrated in Grady County and the immediately surrounding area. According to present information, therefore, the authors doubt whether the State-wide loss of either crop in 1937 reached 1 percent of the yield.

COMPARISON OF DAMAGE IN 1937 WITH THAT OF PREVIOUS YEARS

Farm crops in Oklahoma in 1937 were better than in any of the preceding three years of drought--a fact to be borne in mind in connection with the comparisons made later in this paper between the 1937-38 field-to-field appraisal and the average damage during the past 5-year period reported in response to questionnaires.

The general opinion of farmers throughout most of western Oklahoma was that crow damage to crops in 1937 was not so serious as in the preceding few years. In the three years 1934-36 heavy losses were experienced, and since crops were poor in those years, the damage by crows was more keenly felt. Another factor that added to such damage in those drought years was the unusual lateness of crops, due to slower growth in the hot, dry weather.

There were few instances in 1937 of crows taking as much as one-fourth of a crop, yet many instances were reported to Imler of their having taken a third to half the crop in preceding years. In the Grady County area the damage was more serious in 1935 than in 1936; 1936 crops were so poor, however, that there was little for crows to damage.

In the drought years grain sorghums and corn were almost complete failures on the so-called "hard" or "tight" land of western Oklahoma, while the more favorable sandy soils grew fair crops in some areas. These were visited by large numbers of crows, and when a flock had once fed on a field much guarding was required to keep the birds out, especially when the field was in the line of daily movements to or from a roost.

In the extreme southwestern part of Oklahoma (Harmon, Greer, and Jackson Counties), crows were never a serious problem before the beginning of the drought years (prior to 1934), but in 1935 and 1936 they were very abundant and did much damage. In 1937, however, there were practically no winter crows in this area. It is the authors' belief that crows were drawn there in search of food during the drought years because of a shortage on their normal wintering grounds. The impression that crows were less abundant in 1937 than in the 2 or 3 preceding years prevailed throughout most of the area covered. There is no doubt that the work of the State Game and Fish Commission had decreased the number in the vicinity of the roosts bombed, but it also must be recalled that 1937 was a better crop year and that the birds were probably more widely distributed.

QUESTIONNAIRE APPRAISAL OF CROW DAMAGE

The questionnaires in this cooperative appraisal of crow damage were sent by the State Extension Service in November 1937 to all county agents, with the request that they be distributed to those farmers who could be expected to make accurate replies representative of average conditions with respect to crow damage. Despite the effort made to obtain impartial testimony, however, it developed too late in the investigation to permit complete correction that in some localities questionnaires had been sent only to those farmers who had experienced severe damage. Naturally this tended to raise reports of damage above the average.

Returns were obtained from all but 4 of the 77 counties of the State, a total of 1,171 farmers having submitted complete or partial responses. In connection with tabulation of the replies, summarized in table 2, to aid in obtaining a better picture of crow damage in its sectional aspects the returns were treated in four groups representative of the northwestern, northeastern, southeastern, and southwestern sections of the State (fig. 1).

Although the farmers reporting on crow abundance had not made careful year-by-year censuses of the birds in their respective neighborhoods, the results may be looked upon as a reasonably accurate indication of the trend of the crow population during the decade preceding the questionnaire. In the State as a whole, as well as in each of the four sections considered, there was a preponderance of testimony to the effect that there had been an increase in the number of crows. Of the four sections, the southwestern, with 354 correspondents reporting, disclosed the most emphatic opinion that there had been an increase. In this section about 86 percent of the farmers who expressed themselves believed that there had been an increase, and only 5 percent felt that there had been a decrease. Such a trend in the southwestern Oklahoma crow population has been recognized also by ornithologists in the State.

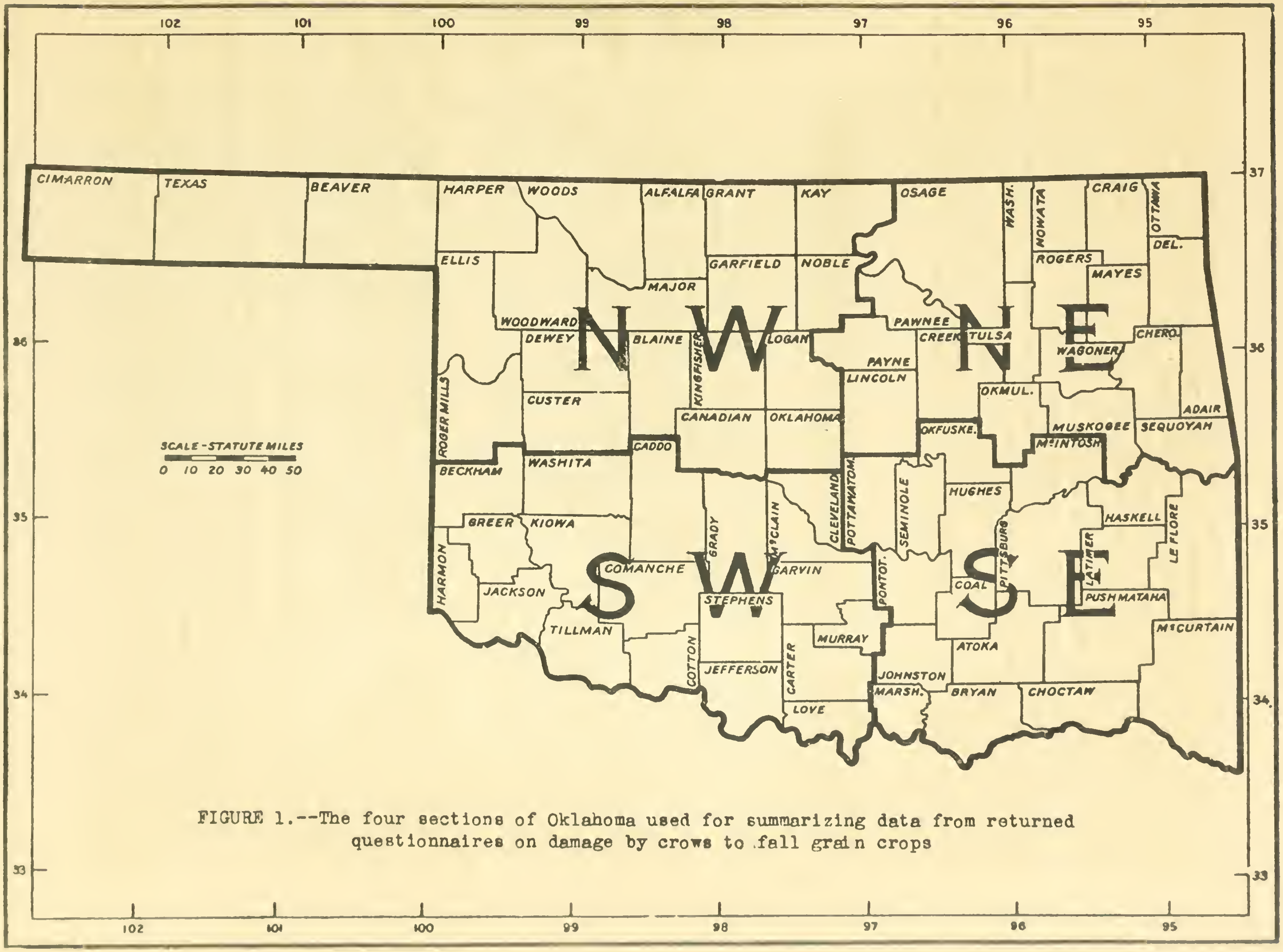

FIGURE 1.--The four sections of Oklahoma used for summarizing data from returned questionnaires on damage by crows to fall grain crops

Less can be said for the validity of the estimates made of the number of crows in the four sections and in the State as a whole. Even when conducted by experienced observers working under the best of conditions, wildlife censuses are difficult and uncertain. The present estimates must be looked upon as the more or less casual opinions of individuals not trained in this field, many of whom probably had given little thought to the actual number of crows in Oklahoma. No estimate of crow abundance was received from 19 of the 77 counties. Though reports were received from farmers in all but 4 of the 77, many failed to record the number of crows at reported roosts, which was admittedly through their inability to make what they felt were fair estimates. Others were more confident, but their testimony was inconsistent. By way of illustration may be cited Noble County, with a reported crow population of 1,000,000, as against 6,100 for adjacent Logan County, long recognized as heavily infested.

TABLE 2.--Summary of data on crow abundance and damage in Oklahoma, obtained from questionnaires returned by 1,171 farmers from 73 of the 77 counties[1]

Items	Sections of State				State total or average
	North-western	North-eastern	South-eastern	South-western	
Crow abundance:[2]	Number	Number	Number	Number	Number
Reports of increase..	141	171	155	304	771
Reports of stationary abundance.	54	66	86	33	239
Reports of decrease..	40	59	29	17	145
Wintering crow population.[3]	1,798,200	204,775	188,385	5,112,350	7,303,710
Crow damage:					
Financial loss--	Dollars	Dollars	Dollars	Dollars	Dollars
Total per farm[4]	34.50	33.29	42.44	66.84	44.04
Total to crops[5]	1,387,541	1,313,476	2,020,626	2,937,959	7,659,603
Percentage loss--	Percent	Percent	Percent	Percent	Percent
Grain sorghums........	6.07	7.22	5.69	12.08	7.50
Indian corn..........	5.08	5.57	4.83	8.60	6.01
Pecans...............	1.11	13.72	11.17	8.52	8.40

[1] Only a part of the data obtained are here tabulated.

[2] Figures refer to the 10-year period preceding issuance of questionnaire.

[3] Estimated by farmers from all but 19 of the 77 counties.

[4] Average of 5-year period preceding issuance of questionnaire.

[5] The average farm loss in each county was multiplied by the number of farms in the county to obtain the total county loss; the county totals were then added to obtain the district totals, and the district totals to obtain the State total.

The estimates of crow population summarized in table 2 appear less reliable than other data furnished in response to the questionnaire and therefore are discussed very briefly. The estimate of 7,703,710 crows for the State is approximately twice the figure Imler felt was fair for the winter of 1937-38 (see page 3). Of this total nearly 95 percent (6,910,550) were reported in the western half of Oklahoma. The southwestern quarter, generally recognized as the principal crow-concentration area of the State, was estimated to contain 5,112,350 birds, more than twice the number recorded for the rest of the State. From censuses made and impressions gained in the course of the field study, it would appear that the questionnaire estimates of crow populations in the western sections of the State are too high and those for the eastern sections too low.

The reports on financial losses on the average farm and their summations into losses by districts and for the State as a whole present a somewhat more logical, though, judged by results of the field appraisal, apparently still an exaggerated estimate of crow damage. That there should be a certain excess over current appraisals is understandable, since the questionnaire returns present the average losses for the previous 5 years, part of which was during a period of drought, when crows were particularly troublesome.

On the basis of the questionnaire's estimate of the number of crows present, the estimated annual financial loss of about $7,500,000 would be equivalent to a loss of about $1 per crow. To many Oklahoma farmers this may not appear excessive, yet there is a great disparity in the sectional estimates of the number of crows inflicting the damage. For instance, the 5,000,000 crows estimated for the southwestern section of the State, where the crow situation is generally admitted to be most critical, are reported to cause a little less than $3,000,000 damage, whereas in the southeastern section more than two-thirds of that amount of loss was reported to have been inflicted by only one-twenty-seventh as many crows.

COMPARISON OF FIELD AND QUESTIONNAIRE APPRAISALS

A direct comparison of the results obtained through field inspection and replies to questionnaires is presented for Grady County, an area in which wintering crows were exceedingly abundant and in which intensive field inspection was carried out. The extent of damage disclosed by the field inspection in that county, has previously been cited (pp. 5-6). For convenience in comparison the data are presented in tabular form (table 3). It is important to mention that data on damage are not altogether comparable, in that the estimates obtained from the questionnaire represent the average for 5 years (1933-37), whereas the inspection appraisal pertains only to one fall and winter (1937-38). Since, however, a preponderance of the correspondents indicated that crows, and apparently crow damage, were increasing yearly in Grady County, the field appraisal for the one season 1937-38 might be expected to represent more acute conditions than the average for 5 years. Nevertheless, since in all matters of this kind yearly fluctuations are certain to occur, any appraisal covering a single season may be at variance with a long-time average. With this reservation, the following brief comments are submitted regarding the comparative data in table 3:

On the basis of the number of farms involved (210 for the field inspection as against 28 for the questionnaire) and the total acreage covered (39,797 acres and 5,586, respectively) the field inspection in this county was much more comprehensive and, for that reason if no other, more nearly accurate than the appraisal by questionnaires. It also had in its favor the merit of detailed inspection and computation of losses. Both were undertaken in November 1937.

For every element of table 3 in which an estimation of value was involved, with the exception of that on pecans, for which no inspection appraisal is available, the questionnaire estimates greatly exceeded those from field inspection. In the matter of financial loss (on the individual farm and in the county as a whole), the questionnaire estimates were more than 16 times those of the appraiser. The inspector's appraisal of a county-wide loss of $18,370 included not only the results of his own estimates of losses to grain sorghums and Indian corn but also a fair allowance for pecans and other crops not critically examined. In scope, this estimate includes all the elements in the questionnaire estimate of $306,187. With respect to the percentage of grain sorghum loss, the questionnaire appraisal was more than 6 times greater and, in the case of Indian corn, 6.7 times greater than that of the field inspector.

TABLE 3.--Comparison of data obtained through direct inspection with those from questionnaires addressed to farmers in Grady County, Okla.

Item	From field inspection	From questionnaires
Farms covered........................number..	210	28
Total area involved..................acres..	1/ 39,797	2/ 5,586
Average area per farm.................do....	189	198
Annual damage per farm...............dollars..	3/ 3.82	4/ 63.63
Total annual crow damage in county......do....	3/ 18,370	4/ 306,187
Grain sorghum losses.................percent..	3/ 3.8	4/ 24.43
Indian corn losses......................do....	3/ 1.7	4/ 11.48
Pecan losses...........................do....	(5/)	4/ 20.00
Crow roosts in county.................number..	2	14
Wintering crows in county...............do....	168,000	1,053,000

1/ 5.6 percent of county.
2/ 0.8 percent of county.
3/ Appraisal in the fall and winter of 1937-38.
4/ Annual average for the 5 years 1933-37, inclusive.
5/ Not appraised.

Reference at this point to table 1 brings to light variations in appraisals due possibly to conditions under which the information was solicited. It will be noted that the Grady County farmers' estimates of damage to grain sorghums, obtained verbally at the time inspection was made, were 6 percent, nearly two-thirds more than that recorded by the appraiser, yet less than a fourth of the loss reported on the written questionnaire.

With respect to the number of crow roosts and wintering crows, it is found that the estimate of the investigator, a trained ornithologist, was only a seventh of that coming through the questionnaires. In this case, however, there is reason to believe that there was a multiple counting of the same birds or groups of birds by several reporters living close to large crow concentrations.

SUMMARY AND CONCLUSIONS

Within recent years there has been an increasing demand in Oklahoma for crow control, and for Federal participation in it. Notwithstanding evidence of the crow's destructiveness locally, brought out in studies of earlier years, nothing approaching a comprehensive State-wide estimate of the financial losses was available. This deficiency halted discussions of suggested Federal participation engaged in by officials of the Biological Survey, the Oklahoma Agricultural and Mechanical College, and the State Extension Service during the summer and fall of 1937 and led to the present study of crow damage. That such a study should be carried out before large expenditures are made and concerted action taken on a control program that might prove to be unwise was generally conceded by all the participants. The procedure outlined was in line with economically and biologically sound wildlife management, namely, investigation before control, a method that should guide all programs for aggressive action against wildlife.

In the appraisal of damage, a cooperative project of the Biological Survey and officials of the Extension Service in Oklahoma carried out during the fall and winter of 1937-38, the Biological Survey contributed the services of an investigator, who from November 6 to January 20, following, made field-to-field appraisals of damage; and the Extension Service sent out and tabulated the returns from questionnaires, to which 1,171 farmers replied. Field appraisal was restricted to estimates of damage to grain sorghums and Indian corn, while the questionnaires also made inquiry regarding pecans and total financial losses.

For the field investigations, two areas were selected for intensive study (1, Grady County; and 2, Roger Mills and Beckham Counties) where from all indications crow damage would be in intensified form. Later developments demonstrated that the choice was well made, and the results of the field work may be considered a reflection of crow activity at its worst under conditions prevailing in Oklahoma at the time the study was made.

It was estimated in the field studies that a third of the State's wintering crows were in Grady and immediately surrounding counties, and, from careful counts made at numerous roosts it was believed that 1,000,000 to 1,250,000 crows were resident in that area during the winter of the study. The crow population of the entire State would, on this basis, be 3,000,000 to 3,750,000. General experience indicates that there has been a perceptible drift of the winter crow population westwardly during the past two decades and that in the years of drought (1934-36) crows occupied areas where previously they had not been abundant. From some of these they have since retreated.

The 210 farms (totaling 39,797 acres) in Grady County on which cropless appraisals were made were selected with the view of giving a true picture of average conditions within an area of crow concentration. Damage to grain sorghums was appraised at 3.8 percent and to Indian corn, at 1.7 percent. Converted into acreages, these losses would be represented by 1,534 and 691 acres, respectively. Conversion of losses in these and other crops into money terms, on the basis of then current prices, placed the annual loss from crows in the county at $18,370. Similar appraisals in Roger Mills and Beckham Counties, in a grain-raising area somewhat smaller than that of Grady County, disclosed losses of 2.6 percent and 6.8 percent to grain sorghums and Indian corn, respectively.

No detailed appraisals were made in other parts of Oklahoma, where crows are less abundant and proportionately less destructive, but from the known distribution of the birds in the State and from the results obtained in areas where they concentrate, the authors do not consider that the Statewide loss to either grain sorghums or Indian corn reached 1 percent of the yield in the fall and winter of 1937-38.

Estimates of losses made by farmers at the time fields were being appraised were consistently greater than those of the investigator, and those obtained through the questionnaires were much in excess of the oral statement of the farmers. For this variance there is partial explanation in that some elements of the questionnaire pertained to the appraisal of conditions over the previous 5-year period, during part of which crow depredations were relatively greater than in the season 1937-38.

Comparison of data obtained from the field with those from questionnaires was possible in one county (Grady) and it revealed that estimates of the percentage of crops lost was about 6 times, and of financial losses, 16 times greater in the returns from questionnaires than in the data obtained from field appraisal. Estimates of numbers of crows (complicated by the fact that the questionnaire returns may have included duplicate counting of roosts and groups of crows) also were higher in the questionnaire returns. On the whole the study again brought out the fact, long known to economic ornithologists, that the more or less casual appraisal of crop losses by their owners is almost certain to be exaggerated. Some of this is due to that most characteristic of human traits, a tendency to overestimate one's misfortunes. The graphic recollection of the worst experiences encountered, and possibly a none too accurate appraisal of damage in the first place, also may tend to aggravate the seriousness of by-gone events.

In the course of the field appraisal the investigator found numerous cases of serious damage that may be cited convincingly as illustrations of the crow's harmful tendencies. There were also many other instances in which the data showed little or no damage. The figures presented and the picture given reflect the average of the conditions observed.

This investigation did not produce all the results that could be desired, for only a small, even though important, part of the State could be covered by the single investigator during the period allotted. Moreover, modifications might have been made in the questionnaire to obtain more precise information on those features of the inquiry that lend themselves to that method of approach. The information now available indicates that, at least in southwestern Oklahoma, there may be need for local control, a situation that is being met to some extent by bombing the roosts. In its State-wide aspects, however, the crow problem is much less serious, and it may even be said in some wheat-raising sections wintering crows are a benefit.

Further field appraisal, including some crops not covered by this initial attempt, is desirable, particularly in the northeastern and southeastern sections of the State. Such an appraisal is now (during the winter of 1938-39) being made. Until this is completed, final word on the desirability of State-wide crow control in Oklahoma must be withheld. On the basis of the statistical data thus far gathered, however, it does not appear to the authors that the crow problem in Oklahoma is at present of sufficient magnitude to demand combined State and Federal action for its solution.